MONTHLY REVIEW

American Electro-Platers' Society

(An Educational Society)

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EDITORIALS

CHICAGO SPECIAL.

H. J. RICHARDS.

This first number of the New Year must be christened the Chicago Special. We heartily congratulate Chicago branch, but warn her that to stay in the lead she will have to hustle.

By work, and work only, can we assure the Monthly Review, the Society and its members a successful and progressive advancement during this year in the realms of Electro-Plating.

INTRODUCTORY ADDRESS AT THE FOURTH ANNUAL BANQUET.

By O. E. SERVIS, President Chicago Branch.

In addressing you this evening, I wish to supplement my remarks at our last banquet, and to repeat that the American Electroplaters' Society was organized by a handful of electroplaters in New York City in 1905. The object of this Society is strictly educational, and permits as members only the foremen platers of the United States and Canada. To be eligible to membership, at least five years' practical experience is necessary, one year of which they must have been in actual charge of a Plating Department.

The object of these annual meetings is to bring the employer or manufacturer and his foreman plater into a closer relationship towards each other, which cannot but ultimately prove a common good for both. The ever-present strife between capital and labor is rapidly giving way where the spirit of co-operation exists; and we humbly invite you to co-operate with us in our efforts to educate and improve ourselves to become better able and competent to manage your Plating Department in a more efficient manner.

We are anxious that the employer of the plater should become thoroughly acquainted with the object of this Society, and to impress upon his mind that he can come to us in time of need, be that need a method of producing a certain finish or the employment of a competent plater.

We have at the present time about 700 members throughout

the United States and Canada, sixteen cities having local branches, of which Chicago has the largest membership, having 104 on its roll in good standing. Among our honorary members there are many well-known educators, who hold chairs in colleges and are authorities on electro-chemical subjects. You can see from this statement that we are in a measure prepared to aid you in the event you call on us.

By your becoming acquainted with us, all doubts as to our intentions and objects should be dispelled. Once you are satisfied, we fully believe, that you would be willing to reciprocate and encourage your foreman plater to become a member of our Society. In this way the American Electroplaters' Society will continue to grow; as it is only by acquisition of new members that any organization can succeed, and, as we acquire a larger membership, we will be better able to aid you in time of need. It has been said, "Many men, many minds"; from our many members we get many ideas on subjects which are discussed at our meetings, giving here one idea and discarding one there. This interchange of ideas causes the member to think along lines which previously may have been totally unknown to him, gradually becoming broader, and, as a consequence, a positive opinion in place of the "I don't know" of the past.

We do not wish to force ourselves upon the unwilling notice of our employers, but we do wish to avoid dispute and suspicion that may exist as to our object being other than educational and social. We would appreciate your aid in interesting your foreman and encouraging membership in the Society.

BRIGHT SILVER PLATING.

By Frank H. Nordman, Cincinnati Branch.

My method is to use a strong solution of sodium cyanide and add to it the carbon disulphide and allow it to take up just what it will. For this purpose I use three ½-gallon bottles and keep them filled at all times. As fast as one bottle becomes empty I again refill it. This then allows this bottle to stand about three to four days. In adding the brightener to the solution I add about 4 ounces in the morning before starting work. During the course of a day's work there will probably be added to the solution as much as a quart of the brightener. By this method I run no danger of adding too much carbon and having it to cause brown spots on the work. All coffin hardware is run through the bright tank, whether it be for the regular bright or so-called white work or for buffing and also for oxidizing.

CONTRIBUTED BY E. W. HEIL, WICHITA, KAN.

Question: What is the matter with by nickel solution? The deposit doesn't fit well. Answer: Lighten the tension on your dynamo; this will stretch the deposit on tighter.

Question: What shall I do with my nickel solution? I put in a pound to the gallon of sal ammoniac and it plates very dark. Answer: Put in some more and make it a black nickel solution.

GOLD PLATING.*

*Chicago Branch Banquet, January 15, 1916.

By J. H. HALL, Chicago Branch.

A great many formulæ have been published in the trade journals, but I have failed to see where the authors have explained in full detail the bright deposition of gold with its affiliate alloys, namely, copper, nickel and silver.

The most important of these alloyed colutions which are used in general by all manufacturing jewelers are the 18 and 16-karat alloyed gold. The 18-karat in general use is prepared in the following manner, and for standard use will take a 6-gallon solution. This jar must be heated in a tank of hot water where the proper electric connections may be easily adjusted. Add 3 ounces potassium cyanide for each gallon of water, the anodes should be composed of 18-karat gold, at least 6x3-inch surface, two of which should be used with platinum wires attached to the anode rods, large enough to carry sufficient amperage. The gold is drawn into the solution by the use of a porous cup or cell. The cup should be filled with warm water and 1 ounce of cyanide dissolved therein. Now place cup in solution and attach the cathode rod and suspend an iron spiral spring, about 4 inches long, inside of the porous cup. Use from 4 to 6 volts pressure, and dissolve about 5 dwts. to the gallon. After drawing off sufficient gold, add ½ ounce phosphate of soda and ½ ounce cyanide to the gallon. The solution is now complete and will give a very bright, rich deposit, standing an acid test in 20 seconds.

Another important solution is a 16-karat basket shading solution. This solution has to be used in a 6-gallon unglassed porous jar placed in a tank of boiling salt water with a zinc cylinder of ¼ inch thickness, placed outside the jar in salt solution. The zinc when connected acts as the anode pole. The aforementioned solution is made in the following manner: 50 dwts. of 16-karat gold is dissolved in aqua regia heated in a porcelain dish on a sand bath. After the gold is dissolved the excess acid is evaporated down to a thick syrup or jelly.

About 2 ounces of hot water should be added and evaporated. This should be done about three times. The gold is now ready to be taken up with cyanide. This should now be transferred to an enameled iron kettle, capacity 6 quarts. Add 2 quarts water. Now take separately 1 quart water and dissolve about 8 ounces of cyanide. Add this to the gold solution very slowly, as only enough cyanide should be added to pick up the gold. No excess cyanide should be used. Solution now should be brought up to 5 quarts. Add the following chemicals and dissolve—

Ferro Cyanide	18 oz.
Prosphate of Soda	9 oz.
Carbonate of Soda	6 oz.
Bisulphite of Soda	3 oz.

This solution contains 10 dwts. to the quarts and is used as a stock solution. Add 1 quart of this solution to 6-gallon porous jar

which should contain 5 gallons of water. Dissolve the following chemicals in this solution:

Ferro Cyanide	12 oz.
Phosphate of Soda	6 oz.
Carbonate of Soda	3 oz.
Bisulphite of Soda	1½ oz.

Use about 6 volts, shake the work well in the basket.

SLIP NICKEL DEPOSITS.

By H. Baum, Cincinnati Branch.

The method for obtaining (slip nickel deposits) a very close, hard and compact deposit of nickel is that the theory is based upon by introducing at certain periods or at intervals sulphuric acid (H_2SO_4) in quantities to suit, and so alternating to carbonate of ammonia ($NH_3CO_2+NH_4O.CO_2$) with great care and precaution. Solution to be kept what is supposed to be a neutral stage, and so causing hydrogen bubbles, all foreign matter and part of an iron sale (FeO); a protoxide which is soluble in H_2SO_4, to be liberated immediately from the work being plated, and at the same time slowly a fine deposit of nickel forms itself, having a smooth and soft finish, which colors up on wheel very easily. No doubt a great many platers are making such deposits every day, which came under my notice. One time I saw a plating rack that possessed these qualities, and try as I will, I could not strip the nickel off without completely wrecking the plating rack. This kind of a plate or deposit I always do find is smooth and alkaline to the touch and never gives the plater any serious trouble if he knows how to work it.

Dayton, O., January 4, 1916.

Mr. H. J. Richards, Editor A. E. S., St. Louis, Mo.

Dear Mr. Richards: I have just received a long letter from the president, Mr. Barrows, in which he states that matters are shaping well for the convention and that he is expecting it to be a huge success. He states that the authorities inform his that there will be no difficulty over the admission of our delegates and visitors and that any of our foreign born members who attend will find their United States naturalization papers a sufficient passport and protection during their trip and that they will not be placed under any more inconvenience than a resident of Canada does when they go back and forth.

I would suggest that you make this the subject of an article in either the January or February Review, giving this information so that each and every one of our members may be informed on the matter. This would reach those of our members who do not attend meetings regularly and who might otherwise fail to learn about it. You might also mention that the returns from the branches are in on the referendum vote on the "Assistant Foreman" amendment and that the result will be submitted to the branches as soon as the Executive Board go over the returns.

Yours very truly,

WALTER FRAINE,

Secretary-Treasurer A. E. S.

DEPOSITION OF METALS BY CONTACT AND IMMERSION.

By H. E. WILLMORE, Secretary Chicago Branch.

For determining in advance whether or not a given salt of a metal will cause a deposition by immersion of the metal upon a certain other metal, the best guide is a study of the single potentials of the metals in question. Between any two dissimilar metals in any electrolyte, a difference of potential may be detected with suitable measuring instruments. For example, if a plate of iron and a plate of copper are placed in the same bath of dilute sulphuric acid, and a sensitive volt-meter of high resistance is connected to the two plates, it will be found that there is an electromotive force of about six-tenths of a volt, existing between the two plates. If the two plates are short-circuited for a time, bubbles of hydrogen will appear on the copper, an indication that current has been flowing from the iron to the copper through the electrolyte, thereby proving that in this electrolyte, the iron has a higher potential than the copper.

In order to give definite values to the potentials of metals, it is customary to measure the difference in potential between each metal and a certain definite standard, known as the normal calomel electrode. This consists of a round bottle of about 2 ounces capacity, with a layer of about one-half inch of mercury on the bottom, and above this another one-half inch layer of mercurous chloride, which has been purified from mercuric chloride by washing with normal potassium chloride solution, and by shaking with metallic mercury. Contact with the mercury may be made by sealing a platinum wire through the bottom of the bottle, or by sealing it through the end of a glass tube, which then dips down into the mercury so that no metallic platinum is exposed. Above these two layers of mercury and of mercurous chloride, or calomel, as it is called, the bottle is filled with a normal solution of potassium chloride, containing 74.6 grams of potassium chloride per liter. Through the cork in the top of the bottle projects a glass tube curving downwards, and ending in rather a narrow point, which is filled also with normal potassium chloride solution. The metal whose single potential is to be measured, is placed in the electrolyte in which its potential is to be measured, and the glass tube just mentioned is allowed to dip into it, in order to provide contact between the two solutions without having them mix. The difference of potential between the metal and the normal electrode is then taken with potentiometer, or with a sensitive voltmeter of high resistance, so as not to allow any current to flow, which would polarize the electrolytic cell. The single potential of the calomel electrode is —.56 volts, so that the single potential of the metal is the algebraic sum of this value and the difference in potential between the two electrodes. Thus, if the difference in potential were seven-tenths of a volt, with the metal higher in potential, then its single potential would be —.56+.7, which equals +.14 volts. If the calomel electrode had the higher potential, then the potential of the metal would be —.56—.7=1.33 volts. The figure for each metal obtained in this way is known as its single potential. Herewith is given a table of

the single potentials of most of the common metals in various electrolytes, the electrolyte in each case being a solution of the salt of the metal:

Metal	*Sulphate*	*Chloride*	*Nitrate*	*Acetate*
Aluminum	1.040	1.015	0.775	.....
Zinc	0.524	0.503	0.473	0.522
Iron	0.093	0.087	.....	.....
Nickel	—0.022	—0.020	—0.060	.....
Tin	.....	—0.085	.....	.....
Lead	.....	—0.095	—0.115	—0.079
Copper	—0.0515	.....	—0.615	—0.580
Silver	—0.974	.....	—1.055	—0.991
Gold	.....	—1.356	.....	.....

The following tables of approximate values of potentials, in normal solutions of the salt given at the head of each column, are taken from Prof. O. P. Watt's "Laboratory Course in Electro-Chemistry":

Sodium Chloride		*Potassium Cyanide*		*Potassium Hydroxide*	
Zinc	0.53	Aluminum	1.06	Aluminum	1.06
Aluminum	0.30	Zinc	0.90	Zinc	0.90
Lead	0.04	Copper	0.81	Tin	0.63
Iron	—.04	Nickel	0.36	Lead	0.28
Tin	—.07	Gold	0.34	Iron	0.27
Copper	—.31	Tin	0.30	Nickel	—.06
Nickel	—.37	Silver	0.28	Copper	—.14
Silver	—.50	Lead	0.15	Silver	—.33
Gold	—.62	Iron	—.12	Gold	—.33

If it is desired to know what potential will exist between two metals in a certain eelctrolyte, simply take the potential of the lower metal and subtract it algebraically from the higher metal. Thus, in chloride solutions, iron has a single potential of 0.087 volts, and lead a single potential of —.095, so that if the two are placed in a chloride bath, the electromotive force existing between them will be the algebraic difference between 0.087 and —.095, which is .182 volts. It may be pointed out here that metals do not possess the same single potentials in different electrolytes, nor do they always preserve the same order of potentials. As an example, in sulphate electrolytes, iron is above copper, while in a cyanide electrolyte, just the reverse is true. As shall be shown later, it is just this matter of relative values of potential which determines whether or not a certain metal may be successfully electroplated in a certain bath.

In plating by immersion, however, the most important facts which may be obtained from these tables are summed up in the following general rule: A metal of higher potential will replace a metal of lower potential in a solution of its salt. Thus, if clean iron is dipped into a solution of copper sulphate, it will become covered with a bright coating of copper. At the same time, iron goes into solution to form iron sulphate, and the relative weights of copper which comes out of solution, and of iron which goes into solution, are to each other as the chemical equivalent weights of the two metals. This is an example of a general rule, in electro-

chemical changes, that reactions never occur singly. If one metal is deposited by immersion, another must go into solution. If current from an outside source is sent through a solution of a metallic salt, by means of two electrodes, metal will be deposited on the cathode, and metal will be taken from the anode, if the anode is soluble, or if it is insoluble, a gas will be formed at the anode, or some other chemical change will occur in the solution at this point. A careful consideration of this principle will make it clear why a deposit formed by simple immersion is never very adherent. Since the deposition of copper on iron is attended by solution of the iron, it follows that the copper deposit is not built on a firm basis, as the iron is being corroded away beneath it, leaving little pockets between the iron and copper in some places, and small particles of insoluble impurities from the dissolved iron in other places. The result is that contact between the iron and the coating of copper is not close enough to form any real good adhesion. The first light flash of copper which occurs is relatively tenacious, because corrosion of the iron has not proceeded very far; but if the article is left in the solution, the solution will get through this thin deposit, which is porous, and attack the iron more and more, until the whole deposit finally curls up and comes off. It is exactly analogous to the old parable concerning the building of a house upon sands which are being washed away beneath it, leaving the house no firm foundation with which to cling to the earth against the force of the winds.

It might also be pointed out here that this matter of deposition by immersion upon a shifting foundation is also one guide to the successful or unsuccessful plating of a metal by outside current. Just as a chain is no stronger than its weakest link, so an electroplated deposit, no matter how thick, is only as adherent as the thin film which is in contact with the base metal. If this first thin film has been deposited by immersion, then it will not be adherent, and it will not help matters any to keep on building up the deposit with the electric current, because the whole thing will ultimately strip off. For successful deposition of one metal onto another from a certain solution, it is important that the single potential of the metal being deposited, *measured in that solution* should be very close to, or if possible, above the single potential of the metal receiving the deposit, otherwise an inadherent deposit will be likely to result.

This tendency towards deposition by immersion may sometimes be circumvented. Taking as an example the deposition of nickel directly on iron in a sulphate solution, the table of potentials shows that nickel has a potential which is about .115 volts lower than that of iron, indicating that nickel will deposit on iron by immersion. This tendency, however, is so slight that the outside current puts an electro-deposit on the article and covers up the iron before deposition by immersion has much chance to take place. The tables show, also, that potentials of metals are not necessarily in the same order in different solutions, hence by using different solutions, it is quite possible to obtain adherent deposits, which are not obtainable in another solution. A good example of this is copper on iron. In sulphate solutions, copper is about six-tenths of a volt below iron, which prevents successful deposition; but in cyanide solutions, as

the tables show, copper is nearly a volt above iron, which explains the adherent deposition of copper on iron in cyanide solution. After enough copper has been deposited in the cyanide solution to cover the surface thoroughly, the work may be transferred to the sulphate bath and a heavy deposit applied without fear of peeling.

Deposition by immersion does not find much practical application, except where only very thin coats are required. Where this form of plating can be applied, however, it has the advantages of convenience, cheapness and simplicity of operation. Gilding is sometimes done this way on articles where only a flash deposit is required, as on keys, cheap jewelry, etc. Coppering from weak copper sulphate solutions is applied to tacks, wire, springs, etc. Silvering solutions for domestic use are put out in handy form, for gullible housewives, to the enrichment of the person who has nerve enough to peddle them. Such deposits are for ornamental purposes only, and if they are to last any length of time, they should be carefully shielded from rough usage.

In making up a bath for deposition by immersion, the thing to keep in mind is that the potential of the metal in the electrolyte should be below the potential of the metal that is to be plated.

In passing, I should like to voice a warning concerning the proper interpretation of the values for single potentials given in the tables. Many men who use these tables, are apt to attach too much significance to the actual numerical values of the single potential. The scale of potentials is merely an arbitrary one, with an arbitrarily fixed zero point, like the zero point on the Fahrenheit thermometer. The zero of single potentials has no absolute meaning in nature, it is simply a reference or starting point, which has been chosen by common consent. There is no good reason, for instance, why this zero point should not have been chosen as the potential of the lowest known substance and every other metal referred to that as a starting point. The fact that one metal has a positive numerical value and another a negative value, does not mean, as some say, that the positive metal builds up electromotive force, while the negative metal opposes electromotive force; but it means merely that between the two metals, in the electrolyte, there will exist an electromotive force which is equal to the actual potential difference between them, in this case being the sum of the two numerical values.

A similar process for plating without current consists of immersing the article in the solution of the metal to be deposited in contact with some metal of high single potential, such as zinc or aluminum. By this act, a primary battery is formed with the zinc as the positive electrode and the article the negative electrode. Contact between the zinc and the article, made outside of the bath, causes current to flow through the system, the zinc becoming the anode and the article the cathode. The current causes metal to deposit out of the electrolyte onto the article, while at the same time an equivalent amount of zinc is dissolved by the electrolyte from the zinc anode. The conditions that have to be met are simply that the article to be plated and the metal to be deposited should both be of lower potential than the zinc or aluminum anode. From

the manner in which the operation is performed, this kind of plating is known as "contact" plating. It has several distinct advantages over the simple immersion method: In the immersion process deposition is attended with corrosion of metal from the surface of the article, with the resulting difficulties already set forth; but in the contact process the corrosion takes place from the zinc plate, and the surface of the article is not corroded, so that the deposit occurs on a perfectly clean and permanent basis, and is just as adherent as a deposit made with outside current. Furthermore, in the simple immersion process, deposition will cease as soon as a deposit has formed over the surface sufficiently dense to prevent contact between the base metal of the article and the solution, because the metal on the surface of the article is the same metal that is in the salt of the electrolyte, in which case, of course, no more replacement of the metal in solution can occur. In the contact process, however, even after the surface of the article becomes covered with metal, a difference of potential still exists between the deposit and the zinc, so that current continues to flow, and will keep on building up the deposit, as long as there is metal left in the solution, and as long as there is zinc left in the metallic form. The whole process is similar to electro-plating in a regular bath, using outside current from a battery, the only difference being that in this case the plating solution and electrodes also make up the battery; and the deposit formed may be just as good as the ordinary electro-deposit.

A modification of this process is found in certain plating powders known under various names, such as "Voltite," "Galvanite," etc. These are composed of some salt of the metal to be deposited, and a metal of high potential, such as magnesium, zinc or aluminum in powdered form, together with some chalky substances, to slow up the action, and to act as polishing agents. The mixture is put on a damp cloth and rubbed onto the cleaned surface of the article to be plated. Action is the same as in the other contact plating just described, the rubbing serving the purpose of bringing new material to the surface of the article, and at the same time the deposit is polished as it is formed. Actual trials of these powders have not given as good results as are claimed for them, and the process considerably more expensive than electro-plating; but the form is certainly convenient for one who wishes to do plating without power or apparatus.

The following formulas are taken from Prof. Watts' book:

Galvanite for Nickeling.

Nickel Ammonium Sulphate	60%
Magnesium (Powdered Metal)	3%
Chalk	30%
Talc Powder	7%

For Galvanizing.

Ammonium Sulphate	15%
Zinc Dust	45%
Magnesium (Powdered Metal)	3%
Chalk	30%
Talc Powder	7%

SILVER PLATING.*

*Chicago Branch Banquet, January 15, 1916.

By C. E. THORNTON, Chicago Branch.

Silver plating is usually considered as one of the most desirable branches of electro-plating, and this is true under certain conditions, such as when there is but one class of work to be handled; then the plater knows about the amount of metal he is depositing at all times and can regulate the anode surface and balance his solution accordingly. But where the plater has all classes of work, consisting of almost every known metal, and every conceivable size and shape, then his troubles are more numerous.

The solution I am at present using contains three and one-half ounces of silver to the gallon and is maintained almost entirely from the anode. It is only found necessary to add silver in the form of a salt when there are a number of large articles being plated, and it is impossible to have the anode surface equal that of the cathode, which will, of course, run the solution low in metal. In such cases I use chloride of silver for replenishing and prefer to prepare it myself, being sure that it is thoroughly washed and free from chlorine; it is then taken up with cyanide before adding to the solution.

It is very seldom found necessary to add cyanide to the solution, as it is kept pretty well supplied by taking the work direct from the striking solution to the regular plating solution without rinsing; the strike being rich in cyanide and low in silver, the solution is kept supplied in this way. So by careful handling and careful regulation of anode surface, a solution can, under ordinary conditions, be maintained almost indefinitely without the addition of either cyanide or metal.

Anodes should be kept in bags, or a good plan is to have a curtain of fine texture, such as muslin, extend the entire length of tank and from surface of solution to within a few inches of the bottom. This curtain is supported by an iron rod, and is placed about an inch from the anode rod, so that when the solution is agitated by putting in and removing work, or when anodes have to be moved, any sediment or dissolved silver that should happen to be on the anodes will fall down behind this curtain to the bottom of the tank instead of settling on work being plated, which causes considerable trouble, especially when the work has to be burnished.

For convenience, in plating different kinds of work, I use two rheostats, one connected with each cathode rod. This is an advantage when there are a few dozen knives and a small amount of hollowware or soft metal to be plated at the same time, since it is a well-known fact that steel knives do not require as strong a current as soft metal hollowware, so by using two rheostats the knives can be plated on one rod and the hollowware on the other without either interfering with the other.

The two rheostats also prove advantageous in other ways. For knives, or any other work of iron or steel, I use two strikes, the first or steel strike, contains three pennyweights of silver and two pounds of cyanide to the gallon and is worked with a copper and a

small silver anode and a strong current. This strike, as well as current, requires careful regulation, as too strong a current, with the large amount of free cyanide the solution contains, will cause the steel to crack, while if current is too weak, there is danger of the work peeling. So it remains for the plater to regulate his solution and current density to meet his own requirements, and this knowledge can only be gained by experience.

The second or regular strike contains about ½ ounce of silver and 18 ounces cyanide to the gallon and worked with a strong current and silver anode.

It is my contention that the most important factor in silver plating is the strike. I believe there are more failures due to the poor condition and improper handling of the strike than anything else. If the strike is kept in good working condition, and the work is properly struck up, assuming, of course, that it is thoroughly cleaned beforehand, there is not much danger of failed work. The strike is a foundation for the operation that is to follow and if the work does not receive a thorough and adhesive coating of silver as a foundation, the following operation will surely be a failure.

Work should not be left in the strike long enough to present a burned or brown appearance, as it would be rough when plated and be very hard to burnish.

A SHORT TALK ON COPPER PLATING.

By W. G. Meggers, Chicago Branch.

I will endeavor to put before you, in a brief way, my personal experience in Copper Plating, outlining a few of the failures and successes.

In my earlier days of electro-plating I firmly believed that if I wanted a heavier or a quicker deposit, it was absolutely necessary to add large quantities of copper salts and cyanide to the solution, and then, if the desired result was not obtained in this way, I further believed it necessary to add conducting salts.

I spent considerable time and energy in adding and mixing the different chemicals to these copper solutions, trying to determine just what was necessary, but the result was not what I was striving for—namely, to increase the output of one solution. Meanwhile, the work to be plated kept piling up; orders were delayed, and I was forced to do something to relieve the situation. I took the matter up with my employer, and after discussing it pro and con, I decided to install at once, a second copper solution to produce this work.

We were located in one of those small country towns, far away from the plating supply houses, and we had no way of getting the necessary chemicals, without a considerable loss of time.

We had on hand, however, a large tank, which at that time was not in use, and which had a capacity equivalent to that of the tank containing the copper solution, or about two hundred gallons.

I took a quick inventory of the chemicals we had on hand and found:

50 lbs. of Copper Sulphate.
½ case of Cyanide of Potassium,
14 lbs. of Sodium Bisulphate, and
1½ gallon o Aqua Ammonia.

After studying a number of formulas, I found that with the addition of Carbonate of Sodium, a copper solution could be produced which would be lighter but at the same time very much like that produced by Roseleur's formula.

I immediately ordered fifty pounds of sal soda from the local grocer. In the meantime the tank was placed in position and about half filled with warm water, in which I had dissolved fifty pounds of sulphate of copper. I took a jar with more water and dissolved fifty-five pounds of cyanide, leaving me with a few pounds of cyanide on hand. I dissolved the fifty pounds of sal soda in another jar of warm water and added it to the dissolved copper sulphate in the tank, thus forming a copper carbonate. To this I added the fourteen pounds of sodium bisulphite to form a cuprous copper, next the ammonia liquid was added, and lastly the fifty-five pounds of cyanide, thoroughly dissolved.

I had no time to allow the precipitated copper to settle for syphoning and washing, so I took a chance and added the cyanide, at once. Leaving the combined sulphate of sodium, formed by the sulphuric acid, in the bluestone and the carbonate of soda in the solution after the cyanide was added, I found that I had produced a nice clear color, and showed about five Beaume on the hydrometer. Connections were then made in a very short space of time, and hot rolled copper sheets, from the factory stock, were used as anodes.

By this time I had put considerable work in the tank, and I must confess, my superstitious nature doubted the results. To my great relief and surprise, however, the copper plating proved excellent in every respect; quick bright, no peeling or blistering, and easy to buff.

This indeed was a lucky turn for me and it set me to thinking. First, I studied the difference in the working of the two different solutions. The old copper solution registered 22 Beaume on the hydrometer. Figuring from this and from the amount of copper and cyanide added regularly to the old solution, it had at least three or four times as much metal in it as in the new solution, this new solution containing but one ounce of copper metal to the gallon. Figuring from the amount of copper sulphate added to the two hundred gallons of solution, I found, in a series of experiments made during the next few months, that by adding a little cyanide regularly, the solution would work very satisfactorily from morning to night, dissolving easily from the anodes, and without much corrosion. I found that the rheostat could be opened to its full capacity and that the work would stand buffing and oxidizing, after fifteen minutes, plating.

Contrary to this, however, my large copper solution required more than double the time to deposit an equal amount of copper. The anodes, used in this solution, too, had to be scoured regularly,

even when more cyanide was added. In proportion to the work turned out from the light solution, a medium current could only be used to prevent peeling or blistering.

I wish to explain, right here, that there was no volt or ampere meter at the plant, and for that reason I can not give you the voltage or amperes, or the power used for each of these solutions. The time was slipping by, however, and inasmuch as the work was plating very satisfactorily in the lighter solution, we did not bother any further with the old solution at this time, but waited until there was a demand for brass plating. When this demand sprung up, we decided it best to throw away the old copper solution and make up a brass solution in this same tank. This was done and with very good results, we using the same solution as outlined above, with the addition of zinc carbonate dissolved in cyanide.

From what I have just related you can readily see that through experimenting and the force of sheer necessity, I produced a solution which up to the present time has given me entire satisfaction, and which I have set up as my standard. Furthermore, while at that time I used cyanide solutions cold in wooden tanks, I have since found it advantageous to use these cyanide solutions warm in steel tanks, and by so doing I have done away entirely with the extra acid copper plating, which operation, I might add, was used by my present firm for years, and thus save a great deal of time, power and buffing material and expense.

I would like to add a few words in regard to the copper plating and cleaning in one operation. I have experimented considerably along these lines and I find that an excess of copper metal and cyanide in an electric cleaning solution was just as unsatisfactory as the excess of copper and cyanide in the copper solution, I have just spoken of.

The best results were obtained, I found by adding to the hot electric cleaning solution, only a little copper dissolved in double the amount of cyanide.

For instance, one pound of copper carbonate and two pounds of cyanide in a hundred gallon cleaning solution is quite enough to start with. Of course the addition of copper has to be made regularly, but by doing this you have your solution in control at all times. In other words, using an electro cleaner with very little copper, while cleaning very greasy work, will prevent the overplating of articles and will not give your work a smutty copper color. Nor is there any danger of cyanide fumes.

Of course, copper cleaner can be used on a great many articles, but personally I have been unsuccessful insofar as using this with satisfactory results on the finer grades of work, such as musical instruments, etc.

I have found that the exchange of ideas all through my work, as well as in all branches and lines of business, benefits one, and I sincerely hope that the few remarks that I have just made will benefit others.

THE A. E. S.

An Address at the Annual Banquet of Chicago Branch, Jan. 15, '16.

By OLIVER P. WATTS.

It may appear presumptuous for one who is not a member to give advice in regard to the activities of the A. E. S., but I have met with the Chicago Branch so often and so pleasantly that, although not a real member of the family, I cannot help feeling that I am at least a brother-in-law to your society. It is a real interest in the A. E. S. which prompts me to offer—let us not call it advice—but a few suggestions.

The organization of the A. E. S. is probably the most important event in the history of electro-plating in America. This is not because of remarkable material accomplishments, advancement of knowledge, or improvement in the methods of plating, although all these things should be accomplished by the society in time. The great achievement of the A. E. S. is, like all the greatest victories of the world, a spiritual revolution. The old spirit of secrecy and distrust, a characteristic of the plater for generations, has been banished, and in its place there is a new spirit of good fellowship, and a desire, not only to obtain knowledge, but to give it to others. I would emphasize particularly the importance of the last item to the advancement of electro-plating and the welfare of this society.

The local branches are doing splendid work, each for its own members. But what is the national society doing for you? Do you derive greater benefit from it than from your own branch? If not, then its possibilities are not yet fully utilized. How can it do more for all members? Not by its meetings, for many of you cannot attend them.

Consider for a moment that older organization, the American Electro-Chemical Society. Only ten or fifteen per cent of its 1,200 members attend the meetings, of which two are held every year. Probably seventy per cent of its members have never attended a meeting, and never will do so. What has brought these men into the society, and what keeps them there? It is not the desire to contribute financially to the advancement in electro-chemistry, which results from the work of this society, but the direct benefit which they receive from the papers which are published in the "transactions."

It must be the same with your society. Unless you have better success in securing attendance at the national meetings than most other organizations with a widely scattered membership, you must reach your members through the printing press. To be thoroughly successful you should give to every member not merely full value for his dues, which would result in only a languid allegiance, but you must return two dollars in value for every dollar which your members pay to the society. How to do this should be the foremost thought of those who are so actively striving for the welfare of the A. E. S.

It would seem that the only way to carry these benefits to every member is by means of the Review. There is much fine material in it now, but there must be more. It must grow. Many valuable addresses and instructive papers of the local branches now reach only the members of a single branch, and much educational

effort is duplicated. They should be at the disposal of every member. Their value lies not so much in hearing them, as in having the printed copy always at hand for study and reference. A second or third reading after a year has elapsed often gives us something that we failed to get at the first reading, either because we were not keenly interested in the subject before, or because our experience in the meantime has enabled us to comprehend what formerly escaped us. The transactions of the American Electro-Chemical Society constitute the greatest repository of information in the field of electro-chemistry. May it be the ambition of your younger A. E. S. to have the files of the Review occupy the same enviable place in electro-plating!

Books on plating are at least ten years behind the times, and probably always will be. The periodicals which treat of electro-plating do so only as a side line; their main interest being in other industries. If there is to be a journal devoted exclusively to plating it must be started, and had best be controlled, by this Society. Such a periodical would unselfishly serve the interests of its readers, instead of serving the dollar, as do the present journals which are run for profit to the publishers. The only present hope of the plater for such a periodical lies in the Review. If you want a journal devoted to your interests you must support it; not merely financially, but, for the present at least, by your own efforts. The editor is carrying your burden, and when he asks for a paper on some subject, or requests a copy of an address at some local meeting, the reply should be a prompt compliance, even though this means much time and trouble to you personally. As the Society and the Review grows, the time will doubtless come when your editor will devote his entire time to his editorial duties, and will receive a commensurate salary. Until that time comes he certainly deserves prompt and efficient support from all members.

To secure adequate means of bringing to your whole membership every paper or address of educational value that is presented to the different branches will be a great step forward, but it is not all that is needed. Some of the branches have already provided laboratories where experiments may be carried on, and as the membership increases, this plan will doubtless be extended. On account of the expense such laboratories will probably be possible only for the larger branches, and so should serve the whole Society. Through the co-operation of the branches having laboratories, it should be possible to carry on investigations along lines that are most promising of results of value to the plating industry as a whole, in addition to serving individual members.

That part of the process of electro-plating which consists of the electro-deposition of metals is based upon laws of nature as definite, exact and relentless in their operation as is the law of gravitation. Some of these, like Faraday's law, are known, and can be exactly stated; others are as yet recognized only as guiding principles, of whose existence we are aware, but which we cannot state in mathematical terms. Doubtless other generalizations concerning the deposition of metals will be made by future platers and electro-chemists, so that the platers of a hundred years hence will

look back with amazement and pity upon our twentieth century ignorance.

A most valuable work that the A. E. S. can do, not only for its own members, but for the advancement of the plating industry, is to collect and set forth where all the world may have access to them, the fundamental facts about the industrial operation of the various plating solutions. For progress in plating we need facts instead of opinions. Electro-plating has in the past depended entirely too much on opinions, and too little on facts. There are few solutions in use today that have not been heartily commended by a half dozen "authorities," and as fervently condemned by another half dozen authorities of equal eminence. The result of this long-continued war of opinions is that progress in electro-plating has been confined almost entirely to the mechanical side. I believe that I am not speaking too strongly when I say that progress in the deposition of metals for plating has been slower in the half century of its existence than in any other art which is based on experimental science.

This plea for facts comes from personal experience. Having tried some experiments with a combined cleaning and plating solution for depositing copper, I presented a paper on this subject before the Milwaukee Branch last May (which, by the way, has just been printed in the Review). At the close of the meeting two members of Chicago Branch who were present informed me that this process had been tried, but the consumption of cyanide proved so excessive that it was abandoned. On the other hand, in the Review for November, we are assured that this too-expensive solution is in use today by many companies, who could not be induced to go back to the ordinary plating solution. Who is right?

How easily this question could be settled for all time if we had a few facts! It only requires a record of the exact weight of cyanide needed for a cold and for a hot cyanide copper solution, with and without the addition of lye. Although hundreds of platers have been using the cyanide copper solution for years, and several have used the cleaning and plating solution for a year or more, the facts in regard to cyanide consumption are not available.

Is it worth while to determine these facts? Let me show you what the cleaning and plating solution will do. Here is a bar of rusty iron taken from a scrap pile out of doors, where it had lain for months. Without any preliminary treatment whatever, it was thrust into the cleaning and plating solution and plated for ten minutes at 26 amperes or 300 amperes per square foot. It was then brushed on a steel wire wheel, but showed no signs of stripping. It is probable that there are conditions where this solution will prove highly desirable; this is for practical platers to determine. It may even prove best to run some classes of work through the electric cleaner first to take off most of the dirt, and so prevent too rapid fouling of the plating solution. If so used, it becomes merely a high-power plating solution of much merit. Besides settling the question of the cost of cyanide in the two solutions above mentioned, reliable data on cyanide consumption would be of value to platers by telling whether or not their copper solution was up to the standard in economy of operation. This is but a single example

of the usefulness of facts concerning the operation of plating solutions.

A fundamental consideration in nearly all industries is the question of cost. If it is proposed to displace an old machine or method of manufacture by a new one, the first questions to be answered are: What will the change cost? How will it affect the cost of manufacture? So far as an outsider can judge, plating is the only happy(?) exception to this rule of modern business. Whatever information of this kind is in the hands of platers is evidently regarded, like all knowledge possessed by the individual plater previous to the founding of the A. E. S., as something so secret and so sacred that should a whisper of it reach another plater or the public, your business would be ruined. Seriously, do you believe this? You are willing to tell your brother plater how to improve his copper solution, and he in turn tells you how to secure better results in nickeling; but will you discuss with him the question which is fundamental in both processes, viz., the cost? If so, you are indeed of the new order!

What a reformation in solutions and procedure would occur if all the nickel platers, for example, could get together with detailed information on the cost of the various steps in nickeling different classes of work! Probably every man would find that he could make improvement in some detail. It would then be easy to say whether or not it is feasible to increase the thickness of the nickel deposit on many articles, and so greatly lengthen their service.

Are the new, rapid nickel solutions more economical than the old double-sulphate bath? An interesting, but by no means simple question, when interest on floor space, tanks, solution and anodes is taken account of. How is the distribution of the cost of plating affected by the metal deposited—with copper, nickel and silver, for example? It is readily seen that for silver the cost of current will be least, and the interest charge on anodes and solution will be greatest.

When information on such matters as these is available to those interested, your friends, the electro-chemists, will no longer spend months or even years in perfecting deposition from some particular electrolyte, that could never be used in competition with the present solutions on account of too great cost. Platers suffer no inconsiderable loss because of mis-directed effort on the part of electro-chemists, who, from a lack of published information on the relative importance and cost of the different operations necessary to plating, devote much of their time available for experiments in plating to matters of trifling importance, or even entirely useless. I speak with some authority in this matter from sad experience.

The "get together" spirit seems to be dominating the business as well as the social world today. This banquet itself is the result of such a spirit. It does us all good to meet our fellows and exchange ideas with them. If instead of this gathering we could meet all the platers of all the branches, and consult, compare notes, and exchange results, what an inspiration and help such a meeting would be! Just such a meeting is possible, if you desire it, through the pages of the Review. Success and long life to it!

WHAT THE BRANCHES ARE DOING

CLEVELAND.

Meets once a month at American House.

The Cleveland Branch has decided not to hold a banquet next month, but instead to hold a smoker which will be held at the Pythian Temple, Huron road and East Ninth street, on Saturday night, January 29, 1916.

Mr. O. C. Easton read a paper on "Sheradizing" at the last meeting night of this branch, December 18th, and exhibited samples. The paper aroused a great deal of discussion as to whether sheradizing was better than electro-galvanizing, and the general opinion was that for some work sheradizing was better than electro-galvanizing.

CHICAGO.

Meets fourth Saturday of each month, 8 p. m., Western Building, Randolph Street and Michigan Avenue. Secretary, H. E. Willmore, 5911 South Boulevard, Chicago, Ill.

Owing to Christmas Day falling on the date of our regular meeting there was no meeting during December of Chicago Branch. Everything is progressing favorably for the annual banquet to be held on Saturday evening, January 15th, at the Morrison Hotel.

MILWAUKEE.

Meets first Friday of each month at West Side Bank Building, Third and Chestnut Streets. Secretary, E. C. Yaeger, 962 Ninth Street, Milwaukee, Wis.

On January 7, 1916, having arranged a smoker for the evening, which was one of the best meetings the Milwaukee Branch had ever held, and well attended.

M. J. Donnelly of Chicago, who was present, recommended the plating of die castings without previous coppering, in an agitated double salt nickel solution containing 2 ounces of magnesium to the gallon, without boric acid and using 3½ to 4 volts. The work will stand buffing after ten or fifteen minutes' plating by this method. The solution should be neutral.

DETROIT.

Meets first Tuesday of each month at 26 East Congress Street. Secretary, B. E. Miller, 543 Townsend Avenue, Detroit, Mich.

The regular meeting of January 4th was called to order by President A. E. Wetmore in the chair and a very large attendance of members were present.

It was decided to hold a banquet on January 8th at the Wayne Hotel in honor of Professor Moore, in appreciation of the helpful instructions he has given to the members of this branch.

T. C. Eichstaedt presented a paper on "Copper-Cleaning Combination Solutions," which was read and is to be forwarded for publication in the Monthly Review.

For the good of the Society, President A. E. Wetmore and A. J. Fritz gave a talk on "Finishing of Stove Urns."

Samples were produced with their different finishes, and in their talk explained in detail the processes used in finishing stove urns.

INDIANAPOLIS.

Meets second Saturday of each month at Hotel Dennison. Secretary, Louis Mertz, 925 Chadwick Street, Indianapolis, Ind.

The regular meeting of December 11th was presided over by President Aufderheide with what we considered a very good attendance.

It was decided that the secretary write to the editor of the Review, asking him to use limited space in the Review for questions and answers, to be asked and answered by the different branches.

Mr. Cartheuser was elected librarian.

Decided that secretary write to platers throughout the State, in view of getting them into our branch.

January meeting called to order on the 12th by President Aufderheide. The attendance was not large, as several members had the grip and could not attend.

The question of lead plating came up, but as it is something new for Indianapolis, there could not be much of an argument; but the one man in the city that really needed information in that respect is getting such good results from the hot dip method without current is fairly well satisfied.

One application received.

PHILADELPHIA.

Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, Philip Uhl, 2432 North Twenty-ninth Street, Philadelphia.

The regular monthly meeting of this Branch was held Friday evening, January 7th, with a fair attendance. The meeting was conducted by our president, Mr. Barr. After the routine business was dispensed with, Mr. D. A. Metz showed samples of bright nickel on white metal toilet articles, using a hot copper cleaner, and gave a very interesting and instructive talk on the same.

ST. LOUIS.

Meets fourth Saturday of each month at Public Library Assembly Rooms. Secretary, F. C. Rushton, 4405 Blair Avenue, St. Louis, Mo.

On account of Christmas, our December meeting was held one week earlier—on the 18th. We had a good attendance, and after routine business was disposed of, Mr. Derleth gave us a talk on the cleaning of metals before plating, and a very interesting discussion followed.

The regular January meeting is to be held on January 20th on account of banquet on the fourth Saturday, January 22d, at the American Annex. Messrs. Musick, Rushton and Deubelbeis are

hustling on the banquet work and the outlook is very favorable. Mr. Lord, superintendent of the Wagner Manufacturing Company of this city, will be one of the principal speakers.

TORONTO.

Meets fourth Tuesday of each month at Occident Hall, Bathurst and Queen Streets. Secretary, Ernest Coles, P. O. Box 5, Coleman P. O., Toronto, Ont.

The regular meeting of the Toronto Branch was held on Thursday, December 23d, with President Salmon presiding over a good attendance. Unsolved problems were discussed and led on to a general discussion on the preparation and methods of handling various lines of work, which proved very interesting. Satisfactory comment being generally voiced after the meeting.

BRIDGEPORT.

Meets third Friday of each month at the office of the Brass World, 260 John Street, Bridgeport, Conn. Secretary, Nelson Barnard, 858 Howard Ave., Bridgeport, Conn.

On Friday, December 19th, we voted to prepare a paper and send to the Review, with the full analysis of the solutions of copper cyanide. Some copper, nickel, brass, silver and gold. There will be a full treatise on these different solutions, and know it will be of interest to all who read it when it is published by you in the Review. We expect to do some very good work this winter along this line, and have formed a class for the full study of chemistry.

We had a lecture of ten elementary parts relative to electrodeposition last winter and are going into the matter still deeper, until we will be able to know just what causes the different chemical actions in the solution aforementioned. This is a vital part the plater must know from now on, or he will be put on the shelf and forgotten unless he wakes up and learns this line of the work. We here in Bridgeport do not intend to take any back seat in this matter. We have a laboratory that is second to none and are going to make full use of it. We elected one new member last meeting and are going to elect a committee to act on this matter of applications and will do our best to increase our membership at least twenty more before next June 1, 1916.

This schedule I am sending you was the course of lectures we had last winter, and the paper you will receive shortly will be on these lectures.

Schedule of the Course of Lectures on "Chemistry of Electro-Plating," Bridgeport Branch, A. E. S.

February 5th—Composition of Matter and Rules for Naming Substances.

February 19th—Acids, Bases and Salts and Their Relations.

March 6th—Nature of Solutions and Electricity.

March 20th—Theory of Electric Deposition.

April 3d—Demonstration of Methods of Finding the Quantity of Free Cyanide and Silver in a Solution.

April 17th—Demonstration of Methods of Finding the Quantity of Free Acid and Metallic Copper in an Acid Copper Solution.

May 1st—Demonstration of Methods of Finding the Ammonia, Copper and Free Cyanide in a Brass Solution.

May 15th—Demonstration of Methods of Testing Nickel Solutions.

June 5th—Practice in the Methods Demonstrated.

June 19th—Practice in the Methods Demonstrated.

NEWARK.

Meets first and third Friday of each month, 8 p. m., 47 Bank Street, Newark, N. J. Secretary, Geo. Rutler, Jr., 333 S. 19th Street, Newark, N. J.

NEW YORK.

Meets second and fourth Friday of each month at 258 Pearl Street, New York City, 8 p. m. Secretary, Wm. Fischer, 345 East 23rd Street, New York City.

CINCINNATI.

Meets once each month at Dennison Hotel, Cincinnati, Ohio. Secretary, F. H. Nordmann, 720 Froom Ave., Cincinnati, Ohio.

DAYTON.

Meets first Wednesday of each month at the Y. M. C. A., Dayton, Ohio. Secretary, Alphonz Lamourcux, 500 East First Street, Dayton, Ohio.

TOLEDO.

Meets the last Tuesday of each month at Toledo University. Secretary, James E. Nagle, 209 Navarre Ave., Toledo, Ohio.

ROCHESTER.

Meets second and fourth Friday of each month at University of Rochester. Secretary, C. V. Haring, 603 Dewey Avenue, Rochester, N. Y.

BUFFALO.

Meets first Saturday of each month at the University of Buffalo, 8 p. m. Secretary, John G. Murphy, 71 Dingens St., Buffalo, N. Y.

APPLICATIONS FOR MEMBERSHIP.

CLEVELAND BRANCH.

Thomas Sweeney.....3185 W. Ninety-fifth St.

INDIANAPOLIS BRANCH.

George Becktel.....Central Plating Company

NEW YORK BRANCH.

D. W. Robinson.....126 John St., Ilion, N. Y.

ELECTED TO MEMBERSHIP.

CLEVELAND BRANCH.

Frank E. Peters.....6316 Sinwood Ave.

Andrew Somerville.....5828 Diamond Ave.

CHICAGO BRANCH.

E. G. Pfister.....203 Evans Ave., Aurora, Ill.

Brother Platers, please answer these questions:

There exists at the present time a big demand for gauges. These gauges are made from the various grades of high-grade steel. They are hardened, tempered and ground to size. In many cases there are a number of gauges in one. This work is very accurate. Now the problem is, How can these gauges be made rust-proof? They are handled continually. They can not be given heat treatment, since they are hard; they cannot be plated, for they are ground to the tenth of a thousand and they can not be placed into any solution that might attack the steel or even warp it. Another condition, some gauges possess very fine threads and edges.

To spray them with lacquer or similar material will not do. I am looking for some method by which the steel may be made rust-proof without affecting the size or temper.

I would also like to obtain some good practical formulas and methods for browning, blueing and blacking gun barrels and parts.

WM. VOSS.

2011 Palmetto St.

THE REPORT OF THE AMERICAN ELECTRO-PLATERS' SOCIETY.

The American Electro-Platers' Society reports a gross increase in membership of 2 per cent for the year of 1915. This percentage of increase, though less than that of the two preceding years, is gratifying in view of the changed industrial and financial conditions brought about by the European war. One new branch of the Society was organized in Toledo, Ohio, and branches have been under consideration in Hartford, Conn., Grand Rapids, Mich., South Bend, Ind., and Louisville, Ky. It is expected that at least three of these will be organized in time to be represented at the next convention which will be held at Toronto, Canada, between the 1st and 10th of July, 1916. The exact date for this event will be set by the Toronto Branch.

All of the branch societies except one show an increase of membership and the financial condition of the branches and that of the Supreme Society is satisfactory, especially when present conditions are considered.

The educational work of the Society is proceeding along the same lines as in the past two years. Classes in elementary and advanced chemistry and physics have been organized in various branches. Those branches having laboratories report definite progress in working out some of the difficult problems which have been under discussion.

The great event of the year was the Annual Meeting and Convention, held at the National Cash Register Factory, Dayton, Ohio, June 3-5, 1915. An ideal convention setting, splendid exhibits, valuable papers and discussions, created enthusiasm and held the interest of the delegates and visitors from start to finish of the most profitable convention in the Society's history.

The 1916 convention at Toronto, Canada, for which the Toronto Branch are making extensive plans and preparations, promises to equal if not exceed, in good accomplished by the Society, that of 1915.